PRELIMINARY DESIGN REPORT

AND

COST ESTIMATE

HILLWOOD BRANCH #1683

OF BRIER CREEK DRAIN #0130

Submitted To:

Genesee County Drain Commissioner's Office
Jeffrey Wright, Drain Commissioner
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Submitted By:

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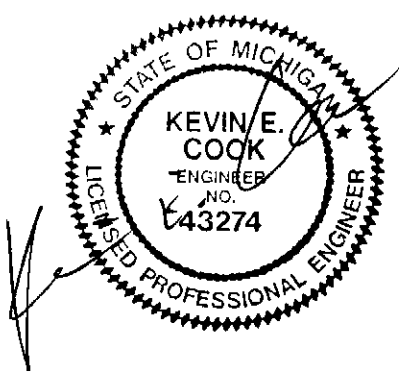


I. Summary

The proposed project consists of the creation of the Hillwood Branch #1683 of Brier Creek Drain located in Section 1 of the City of Burton, Section 36 of Genesee Township, and Section 31 of Richfield Township, situated around Hillwood Drive, north of Potter Road.

The base drain project includes enclosing approximately 4,850 lineal feet of drain with reinforced concrete pipe at an estimated cost of $467,00. As an option, an additional 1,150 lineal feet of 24-inch diameter concrete pipe is proposed at an estimated cost of $78,000. The total project cost, including Option 1, would be $545,000.

All costs are estimated in year 2007 dollars and actual costs may be higher or lower depending upon final design, contractor's bid prices, and the year of construction.

II. Basin Characteristics

A. General

The Hillwood Branch #1683 drainage basin has an area of approximately 190 acres. The ground surface elevations range from 768' to 782'.

Hillwood Drive and the associated residential parcels divide the 190-acre drainage in the north-south direction. There is approximately 65 acres of land west of the roadway and 125 acres to the east. The subdivision consists of 11 estate sized (5 acres +/-) lots with smaller 1/2-acre lots on the Potter Road frontage.

B. Existing Conditions

The following problem exists in the basin:

Based on testimony provided in the Board of Determinations minutes, some parcels along Hillwood Drive have experienced basement flooding in past years.

III. Basis of Design

A. Hydrology

1. Drainage Area

The drainage area of the district is approximately 82 acres.

2. Future Land Use

It has been assumed for the purposes of this study that land use for the year 2020 in the basin will remain essentially as it exists today.

3. Soils

The following soil types are found in the district. (See Figure A)

Map Symbol	Soil Series Name	Hydrologic Soil Group
CvA	Conover Loam, 0 to 2% Slopes	C
CvB	Conover Loam, 2% to 6% Slopes	C

The hydrologic parameter, A, B, C or D, is an indicator of the minimum rate of infiltration obtained for a bare soil after prolonged wetting.

The hydrologic soil groups, as defined by SCS Soil Scientists, are:

A. (Lowest Runoff Potential). Soils having a high infiltration rate even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands or gravels.

B. (Moderately Low Runoff Potential). Soils having a moderate infiltration rate when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse texture.

C. (Moderately High Runoff Potential). Soils having a slow infiltration rate when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water or soils with moderately fine to fine textures.

D. (Highest Runoff Potential). Soils having a very slow infiltration rate when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow sinks over nearly impervious materials.

Some soils area classified as belonging to two hydrologic groups by a symbol such as D/B. The first letter indicates the soil's hydrologic characteristics in the drained condition, the second describes its characteristics in the undrained condition.

The majority of the soil in the district is Conover loam.

This soil has somewhat poor drainage; seasonal high water table; moderately slow permeability; and wet depressions in some areas.

4. Land Use

Most of the land is farmed or idle agricultural land with some residential areas along Maple Avenue and Linden Road. There is also an existing school and church located behind the residential areas. This study is based on the existing conditions.

5. Rainfall Information

Rainfall information is obtained from the Soil Conservation Service. The 24-hour rainfalls for the drainage area are as follows:

Frequency (Years)	24 Hour Rainfall (Inches)
1	2.1
2	2.3
5	3.0
10	3.5
25	3.9
50	4.2
100	4.6

It is noted that there have been numerous rainfalls in the mid-Michigan area which have exceeded the 100 year frequency event.

The rainfall intensity curves used were provided by the Genesee County Drain Commissioner's Office.

6. Runoff Coefficients

"The runoff coefficient as used in the Rational Method expresses the percent of rainfall that appears as runoff. The coefficient C combines the effects of infiltration and surface storage of the watershed." (Handbook of Concrete Pipe Hydraulics) Below are the runoff coefficients used in this analysis.

	Land Use	C
A.	Flat undeveloped lands, farms, nonwooded	0.25
B.	Woodlands and sloped undeveloped land	0.30
C.	Residential	0.40
D.	Roads	1.00

7. Quantity of Flow

The methodology used to estimate flows is the Rational Method. This is one of the most widely used techniques for estimating peak runoff in an urbanized watershed. A description of the method as found in the Handbook of Concrete Culvert Pipe Hydraulics follows:

"The rational formula is fundamentally a ratio in which the total quantity of water falling at a uniform rate on an area is related by simple proportion to the total quantity of water that appears as runoff. This can be expressed in instantaneous form as $Q = CiA$ where Q is runoff in cubic feet per seconds, i is rainfall intensity in inches per hour, A is the area of the drainage basin in acres, and C is the ratio expressing the proportional amount of the rainfall that appears as runoff. This formula is only applicable where the rainfall can be assumed to be uniform both in intensity and in aerial distribution throughout the storm. This assumption applies fairly well to areas of less than 200 square miles."

8. Open Channel Design

Based on the following criteria:

Runoff Coefficient (C) = 0.25
Time of Concentration (Tc) = 82.3 minutes
10-Year Storm Event

The total watershed generated from the entire drainage basin (190 acres) is approximately 74 cfs.

IV. Proposed Improvements

Base Project

Construct approximately 4,000 lineal feet of 30, 36 and 42-inch diameter reinforced concrete pipe storm sewer along Hillwood Drive, continuing east along Potter Road, south along Vassar Road, discharging into the Brier Creek Drain. As a part of the "Base Project", one 24-inch diameter and one 12-inch diameter laterals, totaling approximately 1,900 lineal feet, would be constructed along common lot lines to capture rear yards watershed. The total base project length of enclosed storm sewer in approximately 4,850 lineal feet.

Option 1

Construct approximately 1,150 lineal feet of 24-inch diameter reinforced concrete pipe to capture the low area (water shed of approximately 48 acres, CP-4) in the rear lot of 3169 Hillwood Drive (parcel 400-008). The 24-inch storm sewer would outlet to the main line (Base Project) between parcels 400-008 and 400-007.

V. Cost Estimate

ENGINEER'S COST ESTIMATE

HILLWOOD DRAIN #1683

The drain improvement cost estimates are summarized below as follows:

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	12" Dia. RCP Pipe	400	L.F.	$30.00	$12,000.00
2	24" Dia. RCP Pipe	650	L.F.	$60.00	$39,000.00
3	30" Dia. RCP Pipe	700	L.F.	$75.00	$52,500.00
4	36" Dia. RCP Pipe	850	L.F.	$90.00	$76,500.00
5	42" Dia. RCP Pipe	2,250	L.F.	$105.00	$236,250.00
6	24" Dia. Flared End Section	1	EACH	$2,500.00	$2,500.00
7	12" Dia. Flared End Section	1	EACH	$1,500.00	$1,500.00
8	4' Diameter Drainage Structure	1	EACH	$1,500.00	$1,500.00
9	5' Diameter Drainage Structure	8	EACH	$2,000.00	$16,000.00
10	6' Diameter Drainage Structure	5	EACH	$2,500.00	$12,500.00
11	Connect to Existing Drainage Structure	1	EACH	$2,000.00	$2,000.00
12	Topsoil Surface, 3"	5,389	SYD	$2.50	$13,472.22
13	Seed, Class A	33	LB	$4.00	$133.61
14	Mulch	0.2	TON	$500.00	$121.25
15	Fertilized	668	LB	$2.00	$1,336.09
	TOTAL COST - BASE PROJECT				$467,313.17

Option 1

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	24" Dia. RCP Pipe	1,150	L.F.	$60.00	$69,000.00
2	24" Dia. Flared End Section	1	EACH	$2,500.00	$2,500.00
3	4' Diameter Drainage Structure	2	EACH	$1,500.00	$3,000.00
4	Topsoil Surface, 3"	1,278	SYD	$2.50	$3,194.44
5	Seed, Class A	8	LB	$4.00	$31.68
6	Mulch	0.1	TON	$500.00	$28.75
7	Fertilized	158	LB	$2.00	$316.80
	TOTAL - OPTION 1				$78,071.68
	TOTAL PROJECT COST				$545,384.85

VI. Reference Materials

1. Computing Flood Discharges for Small Ungaged Watersheds, R.C. Sorrell, P.E., Michigan Department of Environmental Quality, Geological and Land Management Division, July 2003.

2. Genesee County Drain Map, Mundy Township, February 1964.

3. Genesee County Composite Map, Mundy Township, Section 5.

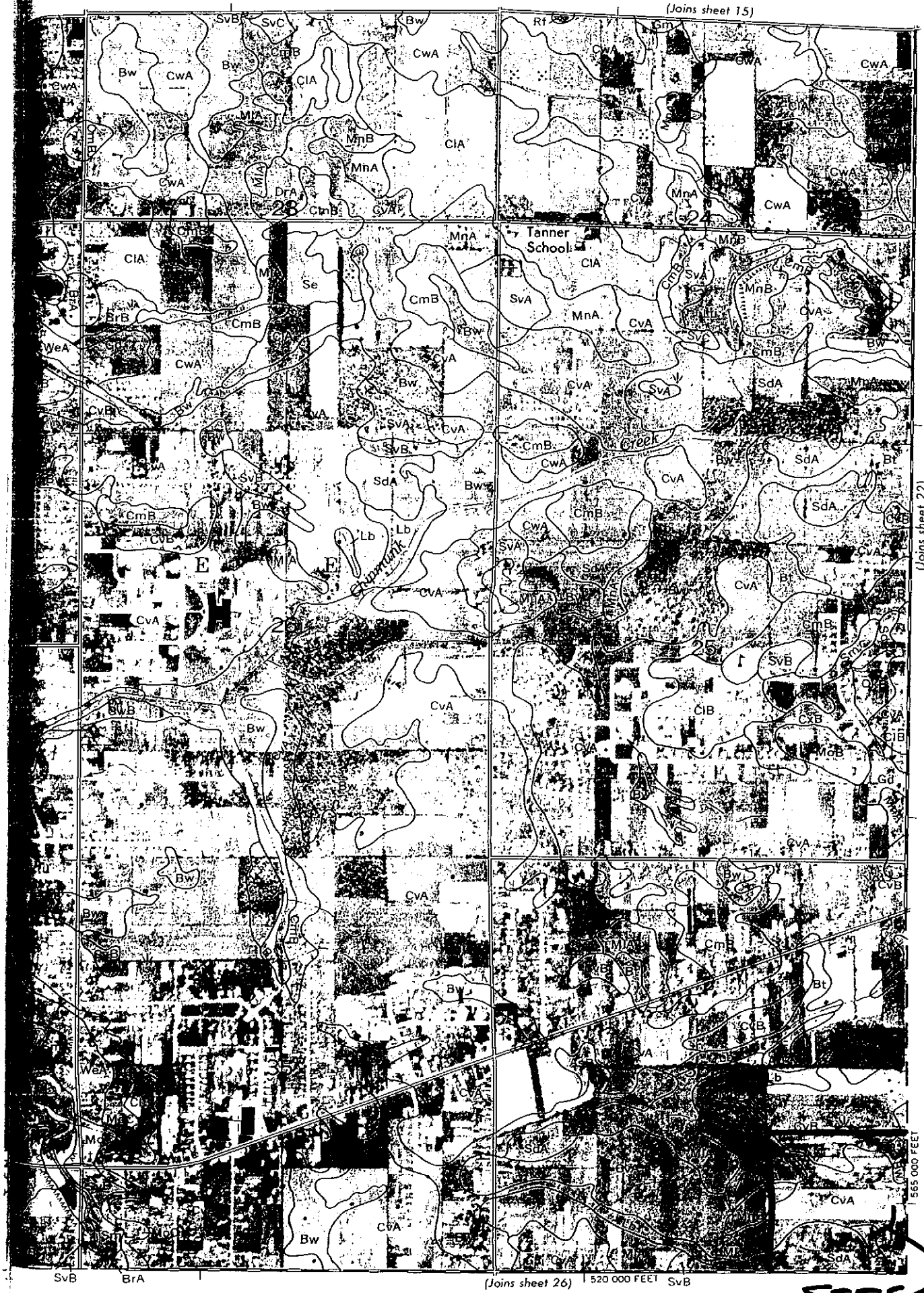
4. Soil Survey of Genesee County, Michigan, United States Department of Agriculture Soil Conservation Service, April, 1972.

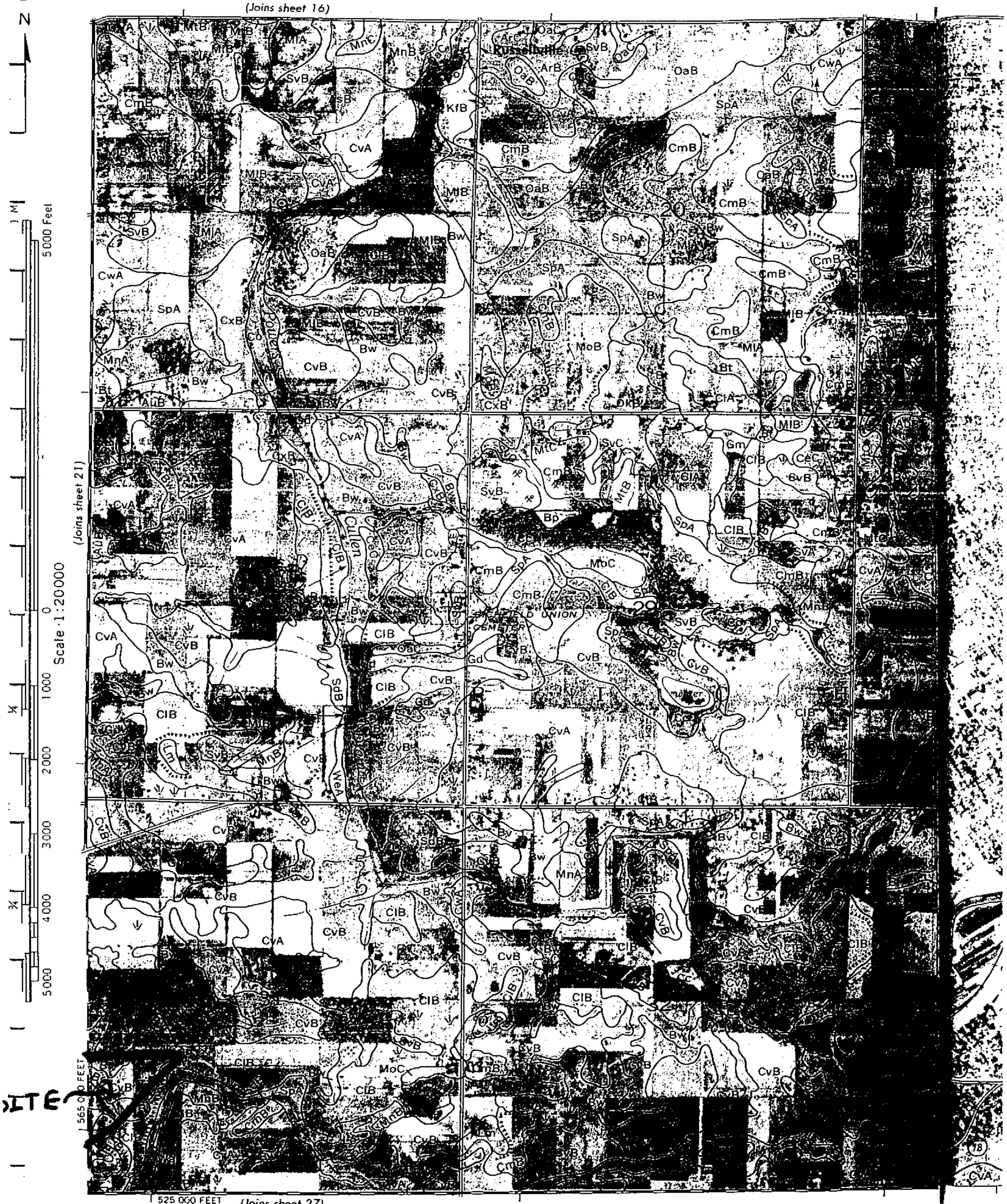
5. Handbook of Concrete Culvert Pipe Hydraulics, Portland Cement Association, 1964.

VII. Appendix

Sheets 1-2	Soil Survey Maps
Sheet 3	Time of Concentration Calculations
Sheet 4	Flow Calculations
Sheet 5	Drainage District Map and Survey

SHEET NUMBER 21

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Time of Concentration Calculations

Initial Time				20	minutes
Surface flow over grass (300 foot maximum)					
upper end elevation =	786				
lower end elevation =	784				
length =	300	feet			
slope =	0.007				
T-Surface flow =	9.11	minutes			
Tc - Grass multiply by:			2	18.2	minutes
Shallow concentrated flow					
upper end elevation =	784				
lower end elevation =	772				
length =	1600	feet			
slope =	0.008				
T-Surface flow =	8.69	minutes			
Tc - Grass multiply by:			2	17.4	minutes
Pipe flow					
pipe distance =	4000	feet			
design velocity (flowing full) =	2.5	fps		26.7	minutes
Total Time of Concentration/Peak Flow				82.3	minutes

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HILLWOOD DRAIN #1683

Pipe Sizing Calculations

Date: 11/30/07
Date Revised: 2/25/08

DESIGN FLOOD FREQUENCY = 10 YEAR STORM
INTENSITY CONSTANTS FOR I = A/(T+D)^N

A = 166.37
D = 22.35
N = 1
n = 0.013

DRAINAGE DISTRICT UPPER	LOWER	AREA A (Ac.)	RUNOFF COEFF. C	A x C	SUM A x C	TIME OF CONC. (Minutes)	INTENSITY I (In/Hr)	DISCHARGE Q (cfs)
CP1	CP2	27	0.25	6.75	6.75	82.30	1.590	10.73
CP2	CP3	55	0.25	13.75	20.50	85.47	1.543	31.63
CP3	CP4	12	0.25	3.00	23.50	82.30	1.590	37.37
CP4	CP5	5	0.25	1.25	24.75	82.30	1.590	39.35
CP6	CP5	48	0.25	12.00	12.00	82.30	1.590	19.08
CP5	CP7	25	0.25	6.25	43.00	83.65	1.570	67.51
CP8	CP7	8	0.25	2.00	2.00	82.30	1.590	3.18
CP7	CP9	8	0.25	2.00	47.00	83.95	1.565	73.56
CP9	OTLT	2.5	0.25	0.63	47.63	85.26	1.546	73.64

		PIPE DIAMETER (Inches)	LENGTH L (Feet)	VELOCITY (fps)	TOTAL TIME (Minutes)	HYDR. GRADE LINE	DESIGN GRADE %	DESIGN VELOCITY (fps)	DESIGN CAPACITY (cfs)
CP1	CP2	24	650	3.42	85.47	0.23	0.24	3.54	11.11
CP2	CP3	30	700	6.44	87.28	0.59	0.60	6.49	31.86
CP3	CP4	36	550	5.29	84.03	0.31	0.32	5.35	37.83
CP4	CP5	36	450	5.57	83.65	0.35	0.36	5.68	40.13
CP6	CP5	24	1150	6.07	85.46	0.71	0.72	6.13	19.25
CP5	CP7	42	850	7.02	85.67	0.45	0.46	7.11	68.42
CP8	CP7	12	400	4.05	83.95	0.80	0.80	4.07	3.20
CP7	CP9	42	600	7.65	85.26	0.54	0.54	7.71	74.13
CP9	OTLT	42	800	7.65	87.00	0.54	0.54	7.71	74.13